The American Fertilizer

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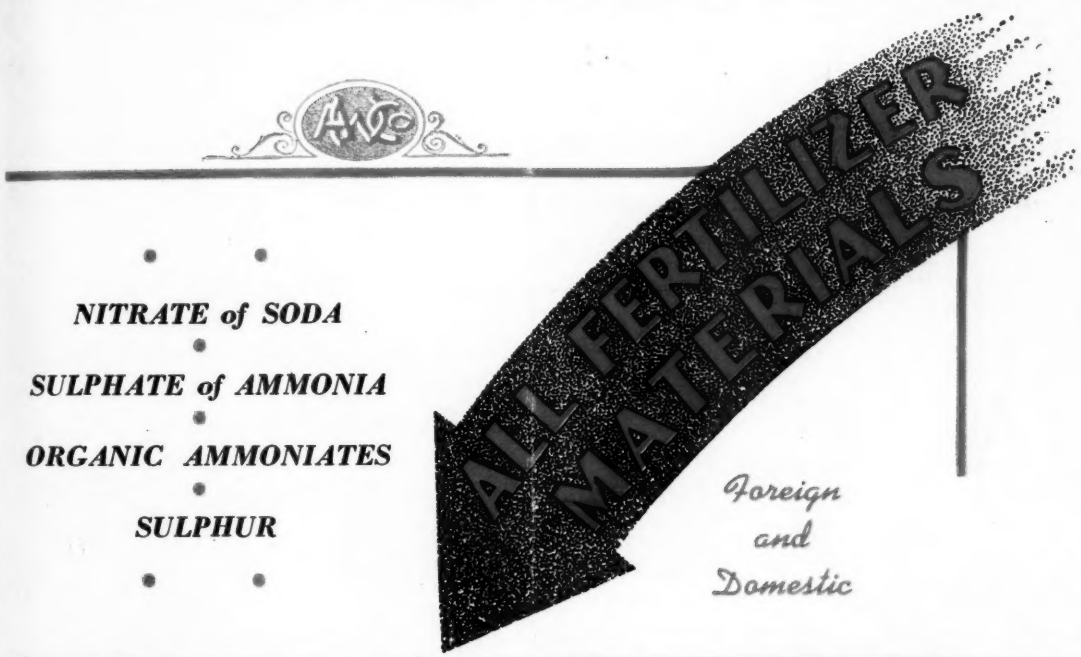

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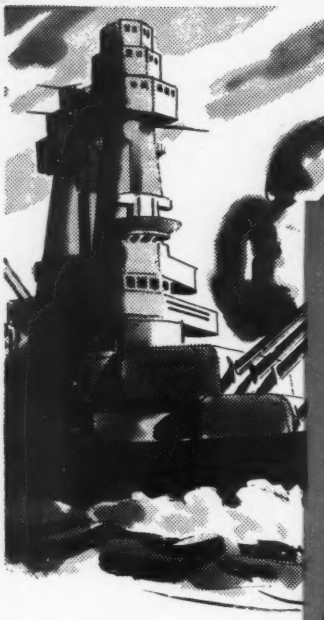

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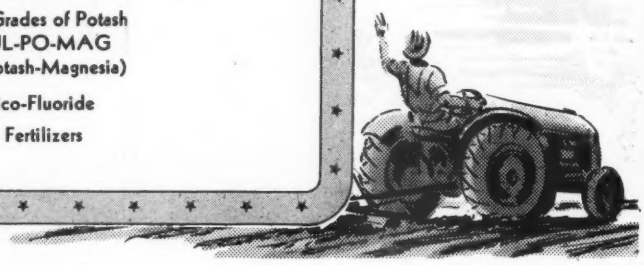

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"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

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Boron in Agriculture*

By E. M. KITCHEN

New York, N. Y.

THE increased interest in the boron-deficiency work has resulted in symptoms of deficiency being described on 34 crops. Most of the intensive investigational work has taken place during the past six years. The early turnip, apple, and cauliflower tests were the forerunners of the table beet, tomato, sugar beet, flax, mangel, celery, cabbage, etc., and most recently of the legume tests with alfalfa outstanding. Red clover, crimson clover, and ladino clover are being checked for response to boron at the present time, but no published information from U. S. stations is yet available.

It does not seem necessary to review the earlier developments of boron deficiency since so much has been published and nearly everyone is familiar with the literature.

One of the important developments during recent years has been the legume crops. While the first work on alfalfa, in this country, was done in 1936, there was a lapse of three years before more work was published. In 1937, Willis and Piland (*1*) of North Carolina, and McLarty (*2*) of British Columbia, attributed "alfalfa yellows" to boron deficiency. They corrected the trouble with 5 to 10 pounds of borax per acre.

The symptoms given by the investigators (*1, 2*) were very similar. The later investigators have found the symptoms to be the same in all sections of the country and in Canada. The yellowing of the terminal growth, shortening of internodes, rosetting of terminal growth, and death of terminal buds are the characteristic symptoms of boron deficiency. The boron yellowing is generally confined to the upper portion of the plant. Potato leafhopper yellowing, according to Colwell and Lincoln (*3*), is hard to distinguish from boron deficiency yellowing as far as color is concerned. The leafhopper yellowing may give a streaked appearance in which the veins and mesophyll adjacent to them remain green. The yellowing may also take place at the distal portion of the leaf as a "V" in which the apex represents the point of feeding, and the sides are bound by veins extending to the edge of the leaf. In other cases the yellowing may be more uniform, and from this standpoint alone cannot be differentiated from the uniform yellowing of boron deficiency. There might also be a pronounced boron deficiency with little or no yellowing.

The distribution of discoloration is one of the most important factors for distinguishing between the two types of yellows. The leaves injured by leafhoppers occur at various heights on a given shoot, while the yellowing or reddening caused by boron deficiency is always confined to terminals. There is another type of yellowing associated with common leaf spot caused by Pseudopeziza medicaginis. This organism occurs as small, circular, dark brown spots on the lower leaves of the alfalfa, and if sufficiently severe, causes them to turn yellow and drop.

Alfalfa yellows has been worked with in several states and Canada. Ewen at Guelph, Ontario, and Dr. Stevenson at Ottawa have found borax to be very effective on alfalfa yellows. McLarty, Wilcox, and Woodbridge (*2*) in British Columbia, Willis and Piland (*1*) also Piland and Ireland (*3*) of North Carolina, Hendricks (*4*) of Tennessee, Grizzard and Matthews (*5*) also Hutcheson and Cocke (*6*)

*Paper presented before Division of Fertilizer Chemistry, American Chemical Society, Buffalo, September, 1942.

of Virginia, Midgley and Dunklee (*7*) of Vermont, Powers (*8*) of Oregon, Colwell and Baker (*9*) of Idaho, Colwell and Lincoln (*10*) of New York, Donaldson (*11*) of Massachusetts, Brown and King (*12*) of Connecticut, Baur, Huber and Wheeting (*13*) of Washington, and Cook (*14*) of Michigan, have found borax to be very effective in controlling yellows.

Fewer Weeds and Increased Yields of Alfalfa

The rates of application of borax vary from 15 pounds per acre up to 40 pounds per acre. Colwell and Baker (*9*) found that around 40 pounds of borax gave good results on Idaho soils. In most of the eastern states the range of 15 to 30 pounds per acre seems to give the best results. The tolerance of alfalfa to borax is quite high. Several investigators have applied as much as 100 pounds per acre, in some cases more, without any anxiety.

One feature that has been noted is the fact that borax-treated plots have a much lower weed count than untreated areas. Hutcheson and Cocke (*6*) found that in dry seasons, when the yellows seem most severe, a heavy growth of crab grass and other late summer weeds crowd out and replace the weakened alfalfa plants. The author noticed this condition in North Carolina. The treated plots were free of weeds while the balance of the field was infested with crab grass and foxtails. Tests in Tennessee and other states bear out this fact quite well. Authorities believe that the healthy, thick growth does not allow weeds to become established and a "weed free" stand is maintained. It is not likely that the amount of borax used is toxic to the annual weeds.

Boron deficiency has a definite bearing on the life of the alfalfa fields. In the western states it is not unusual for a field of alfalfa to last 8 to 10 years and even more. This is not the case with most of the eastern states. Hendricks (*4*) finds that in the second or third year the alfalfa often seems to have a hard time surviving the hot, dry periods of late June, July, or August; it then grows slowly, the leaves turn yellow, and the summer showers seem to grow crab grass better than alfalfa. Hutcheson and Cocke (*6*) found that in the eastern section of Virginia, they could grow alfalfa producing high yields by using adapted seed, lime, and rather heavy applications of mineral fertilizer. These stands only persisted for short periods, usually being reduced to such an extent that they became uneconomical by the end of the second year. In tests at Chatham they found that the borax-treated areas gave vigorous growth, and good stands were being maintained, while the untreated areas were deteriorating rapidly and would appear to be too thin for profitable production during the third year of growth.

Increases in yields of alfalfa from borax applications have been reported from every state that has conducted tests. Colwell and Baker (*9*) of Idaho report that as a result of their tests they conclude that many of the soils in northern Idaho are deficient in boron for alfalfa, and that substantial increases in yields can be obtained by the addition of borax. Baur, Huber, and Wheeting (*13*) of Washington report that although yields varied in several fields because of different soil fertility and management practices, increases in yield were obtained on all plots that had received borax. The size or magnitude of the increases from borax applications were proportional to the severity of the deficiency. Greater increases in yields from additions of borax were generally obtained from fields in a comparatively high state of fertility than from applications to poorer soils, and the addition of borax to manured fields on boron-deficient soils increased growth materially when compared to manure applications alone.

Powers(*8*) of Oregon states there are 50,000 acres of alfalfa in the Willamette Valley that will yield ½ to 1 ton more an acre from a 30-pound-per-acre borax application. Midgley and Dunklee (*7*) found that on one soil type, mineral fertilizers without borax were ineffective for the production of alfalfa. In conjunction with borax, however, alfalfa yields doubled with practically all cuttings. When 40 pounds of borax per acre were applied, the yield was much superior to that secured when less was applied. Hutcheson and Cocke (*6*) in their tests at Williamsburg, Va., found that 10 pounds of borax at time of seeding in the fall of 1939 gave a marked increased yield from each of the five cuttings in 1940 and gave a total increase of 4,693 pounds of field-cured hay per acre. The spring seeding, with 10 pounds of borax per acre plus fertilizer, gave a total increase of 4,517 pounds of field-cured hay per acre for four cuttings. At Chatham, Va., borax was applied immediately following the first cutting at the rate of 15 pounds per acre and the second cutting was increased over 600 pounds per acre as against the check area.

Investigators have found consistent increases in hay fields from relatively small applications of borax.

(Continued on page 24)

Effect of Fertilizer on Potato Yields

By BAILEY E. BROWN[1]

Introduction

THE importance of plant food from the standpoint of potato production cannot be overemphasized. Evidence confirming this fact has been obtained in hundreds of field experiments comparing fertilized and unfertilized potato plantings (see Fig. 1). Potato growers in many sections of the United States know what happens when the fertilizer spouts or tubes of the potato planter become clogged and a row or part of a row gets no fertilizer. Differences in growth and yield in such cases usually are markedly in favor of the fertilized potato plants. Furthermore, that it pays to use fertilizer on the potato crop is evidenced by the fact that potato growers purchase about 600,000 tons of fertilizer annually at an approximate cost of 20 million dollars.

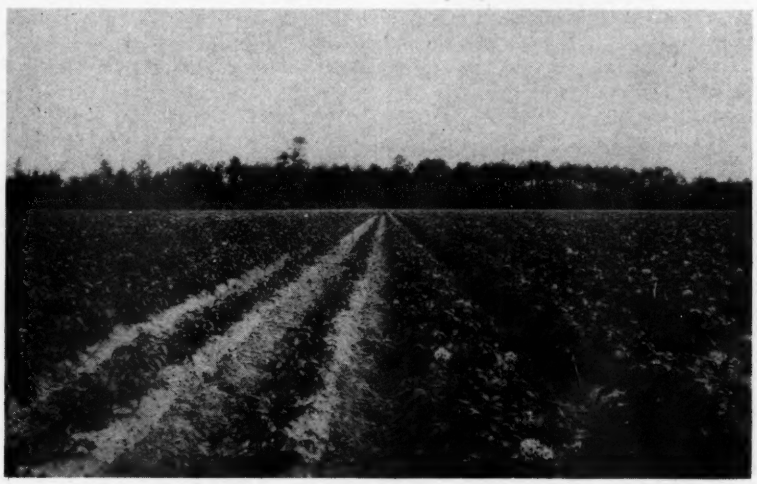

FIG. 1. What happened when no fertilizer was applied. Two unfertilized rows on left produced at the rate of 73 bushels per acre. Two fertilized on right, 183 bushels per acre. Increase due to fertilizer = 110 bushels per acre. Fertilizer experiment near Norfolk, Va., conducted cooperatively by the Virginia Truck Experiment Station and the Bureau of Plant Industry, U. S. D. A.

During the early part of 1942, the writer was requested to furnish data on the use of nitrogen in potato fertilizer, chiefly concerning nitrogen rates. To do so, recourse was had to yield records obtained in potato fertilizer experiments conducted cooperatively by the Bureau of Plant Industry, United States Department of Agriculture, and a number of State Agricultural Experiment Stations. As the nitrogen fertilizer data were being assembled an opportunity was afforded to tabulate potato yields from fertilized and unfertilized experimental plots obtained in widely separated sections of the Middle Atlantic and Northeastern States over a long period of time.

In this paper these results have been assembled to help answer many inquiries as to what effect fertilizer has on potato yields in comparison with no fertilizer. The yields were obtained from fertilizer experiments conducted in cooperation with the Maine, Michigan, New Jersey, New York, Ohio, and Pennsylvania Agricultural Experiment Stations and the Virginia Truck Experiment Station.

A comprehensive study has recently been published by the National Fertilizer Association on the value of fertilizers for potatoes

[1]Senior Biochemist, Division of Fruit and Vegetable Crops and Diseases (Potato Investigations), Bureau of Plant Industry, U. S. Department of Agriculture.

and certain other crops.[2] For potatoes, the average increase in crop value for each dollar spent for fertilizer is given as $3.11. According to the same survey the increase in crop value varies in different sections, running as high as $7.44 in Oregon, where 2,500 tons of fertilizer were used on the potato crop in 1938, to as low as $1.86 in Delaware where 2,000 tons were used. Considering some of the heavy potato-producing States, the estimated increase in value given for Maine is $2.90; for New York, $2.55; for New Jersey, $2.52; for Pennsylvania, $3.78; for Virginia, $2.51; for Ohio, $3.04; and for Michigan, $3.62.

An additional estimate given in this survey shows that average yields with and without fertilizer were, respectively, 205 and 88 bushels, an increase of 117 bushels for fertilizer. The average fertilizer application was 1,267 pounds per acre.

Presentation of Results

The results obtained from the cooperative potato fertilizer experiments are presented in Table I. Information is given relative to location of the fertilizer experiments, varieties grown, fertilizer rate and analysis, duration and number of tests, and acre yields. The yields are shown graphically in Fig. 2. The number at the top of each white bar (Fig. 2) is the acre yield obtained with fertilizer; that in the "white spot" at top of each black section is the yield without fertilizer; and that at bottom of the black bar represents the average increase in yield from use of fertilizer. The average yields without fertilizer were always below those with fertilizer even though nearly all growers practiced either a rotation or grew a green-manure crop as a source of organic matter; used any available manure; planted excellent seed stock; and performed all cultural operations, such as seed-bed preparation, spraying and others, efficiently. The only additional step taken was to use fertilizer, in which case the yield figure at the top of the white section of the bar tells its own story.

Regardless of variety, soil type, or duration and number of experimental tests, the fertilized potatoes produced an over-all average yield of 247 bushels to the acre; the unfertilized, 174 bushels; thus giving an average difference of 73 bushels in favor of fer-

(Continued on page 26)

[2] *American Fertilizer Practices (Second Survey)* by H. R. Smalley, Robert H. Engle and Herbert Willett, The National Fertilizer Association, 1939. A report relating to the use of commercial plant food presenting information obtained by a survey among 32,000 farmers in 35 States.

TABLE I. POTATO YIELDS OBTAINED IN DIFFERENT SECTIONS WITH AND WITHOUT FERTILIZER

Study No.	Section	Soil Type	Variety	Fertilizer rate per acre	Fertilizer analysis	Period run	Actual no. of tests*	Average Yield*		
								Fertilized	Untertilized	Increase
				Pounds				Bu.	Bu.	Bu.
1	Maine	Caribou loam	Green Mt.	1,800–2,000	4–8–8	1923–38	24	382	230	152
2	Maine	Caribou loam	Cobbler	1,800–2,000	4–8–8	1917–38	27	334	194	140
3	Penna.	Berks shale loam	Russet Rural	1,200	4–8–8	1923–33	11	328	263	65
4	Penna.	Volusia silt loam	Russet Rural	800	4–8–8	1928–31	4	255	190	65
5	Penna.	Hagerstown clay loam	Russet Rural	1,200	4–8–8	1928–30	3	231	196	35
6	Penna.	Muskingum stony loam	Russet Rural	600	4–8–8	1928–31	4	192	158	34
7	N. J.	Sassafras loam	Cobbler	1,800–2,000	4–8–8	1919–32	30	220	148	72
8	N. Y.	Sassafras loam	Green Mt.	1,800–2,000	4–8–8	1919–23	6	272	181	91
9	N. Y.	Ontario stony loam	Russet Rural	600	4–8–8	1928–32	10	269	216	53
10	N. Y.	Lordstown stony loam	Russet Rural	600	4–8–8	1926–30	6	244	169	75
11	N. Y.	Honeoye loam	RussetRural	600	4–8–8	1928–32	5	177	129	51
12	Virginia	Sassafras sandy loam	Cobbler	1,800	6–8–6	1920–31	10	232	142	90
13	Virginia	Norfolk sandy loam	Cobbler	1,800	6–8–6	1918–31	15	193	101	92
14	Ohio	Canfield silt loam	Russet Rural	1,500	4–10–6	1933–36	5	233	186	47
15	Mich.	Montcalm sandy loam	Russet Rural	600–800	4–12–8	1931–36	6	207	171	36
16	Mich.	Mance ona grav. s. l.	Russet Rural	800	4–12–8	1933–37	5	182	113	69

Maine studies: 1 and 2 were conducted in Aroostook County.

Pennsylvania studies: No. 3 was conducted in Lehigh County; No. 4 in Mercer County; No. 5 in Lehigh County; and No. 6 in Cambria County.

New Jersey studies: Made chiefly in Monmouth and Mercer Counties.

New York studies: No 8 was conducted in Suffolk County; No. 9 in Monroe County; No. 10 in Steuben County; and No. 11 in Genessee County.

Virginia studies: No. 12 and No. 13 were conducted in Eastern Shore and Norfolk sections, respectively.

Ohio studies: Made chiefly in Wayne and Richland Counties. Results obtained on Chenango silt loam are included.

Michigan studies: No. 15 and No. 16 made in Montcalm and Antrim Counties, respectively.

*All tests in any given area. Total number of tests for all areas = 171.

AAA Program for 1943 Announced

A 1943 program for the Agricultural Adjustment Agency placing emphasis on the production of war crops and stressing stiff payment deductions on farms failing to meet war production goals was outlined today by the U. S. Department of Agriculture.

AAA crop payments in 1943 will be conditioned on the degree to which each cooperating farm family carries out its individual farm plan which will represent each farm's share of the national war production goals. The farm plans will be a virtual blue-print of intended 1943 production and will be worked out by each farmer with the assistance of AAA committeemen.

In his plan the farmer will list (1) the wartime crop adjustments he will make to help him to meet his war production goals, and (2) the conservation practices that he will undertake to help get increased acre yields in 1943. Farmers having basic crop allotments may earn production adjustment payments and all farmers are eligible to earn production practice payments, sometimes called conservation payments.

Payments are designed to help get full production of the kinds and in the amounts needed, and all crop payments are to be contingent on the degree to which the farmer meets his goals. Deductions will be made from the farm's maximum production adjustment payments, or allowance, for failure to meet specified goals of both allotment crops and special war crops.

Allotments for corn, cotton, peanuts, rice, tobacco, and wheat are established in accordance with predicted need, and growers will be asked to plant closely to such allotments. Failure to plant at least 90 per cent of these crop allotments will result in payment deductions at a rate 5 times the compliance rate. This means that a farmer's crop payment would be wiped out entirely should he plant only 70 per cent of his allotment. Under certain conditions, farmers will be able to substitute special war crops or designated feed crops for their allotment crops and still remain in compliance.

Since 1943 crop allotments for cotton, tobacco, and wheat indicate maximum production that will be needed, farmers will be asked not to exceed such allotments and their crop payments will be deducted at a rate 10 times the compliance rate for overplanting. The deduction for excess corn acreage will be at the same rate, except that the deduction will be limited to the corn payment alone unless the acreage of corn on the farm exceeds the usual acreage.

There will be strong emphasis on meeting war crop goals on each farm. Such goals will be worked out by farmers with their AAA committeemen. Failure to achieve 90 per cent of war goals for a farm will incur crop payment deductions at the rate of $15 per acre.

There will be no deductions under the conservation practice phase of the program, each cooperating farmer being paid in accordance with the degree to which he earns his conservation allowance.

In the production practice or conservation phase of the program, each of the 5 regional divisions of AAA, working with State AAA committees and the Soil Conservation Service, has designated practices by areas which, if carried out, will make maximum contributions to production. This localizing step places greater responsibility in the hands of local administrative people who are most familiar with problems and needs of each county and community.

Rates of payment for specific practices and for allotment crops will be announced later.

The 1943 national acreage allotment for wheat has been set at 55,000,000 acres, cotton at 27,400,000 acres, and corn at 43,423,000 acres for the Commercial Corn Area. Farmers are urged to shift wheat and cotton acreages where possible into war crops to achieve a national goal of 52,500,000 acres instead of 55,000,000 acres for wheat and 22,500,000 acres instead of 27,400,000 acres for cotton. National allotments for other crops will be announced before spring planting.

State production goals for the special war crops are now being studied at four regional meetings at Denver, Chicago, Memphis, and New York. These State figures will be broken down to county goals by State USDA War Boards and will be distributed among the farms in the county by the County War Boards with the assistance of AAA committeemen. These goals will be distributed on the basis of adaptability of soil; availability of cropland, equipment and labor; past acreage and production of war crops; and other related factors.

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Sale of Oilseed Meal as Fertilizer Prohibited

The Department of Agriculture announced on December 31st the issuance of an Oilseed Order by the Commodity Credit Corporation prohibiting purchases, sales, and deliveries of oilseed meals for the manufacture of mixed fertilizer for sale. This action is taken to increase the supply of meals needed by livestock feeders in meeting production goals in the 1943 Food for Freedom program.

The Order provides that beginning January 2, 1943, and until further notice "no person shall place any purchase order for, accept delivery of under existing contracts, or acquire by crushing, any oilseed product for manufacture into mixed fertilizer for sale."

"Purchase order" is defined as "any contract or offer to purchase, any agreement to acquire by exchange, any request for shipment or delivery under existing contracts, or any other action heretofore or hereafter taken by any person to obtain delivery of oilseed products." These products include cottonseed, soybean, peanut, and linseed oil meals or cake of merchantable quality for feeding.

The Order expressly provides also that "no person shall sell or deliver any oilseed product if he knows or has reason to believe that such oilseed product is to be used for manufacture into mixed fertilizer for sale." Sellers are permitted at their discretion to require certification from buyers that oilseed products covered by purchase orders will not be manufactured into mixed fertilizer for sale.

During the fourth quarter of 1942 the crushings of production of oil meals has been about 20 per cent larger than during the corresponding period of 1941. As a result of the movement of soybeans to the South for crushing in cottonseed mills, and the movement of soybeans to the East and West coasts for crushing in linseed and copra mills, the production of oil meals during the first quarter of 1943 will be about 50 per cent larger than during the corresponding period of 1942.

CCC officials expressed the hope that the increased supply of meal during the first quarter of 1943, together with the limitations on inventories announced December 24th, and on the use of meal in mixed fertilizers, will make adequate supplies available for livestock feeding. Large supplies of feed wheat, millfeeds, and other grains also will be available for feeding in 1943. Officials stated that the unprecedented demand for high protein feeds is accentuated by reduced supplies of other protein feeds such as tankage, scraps, and fish meal.

N. F. A. Tops Membership Goal

During the past few months, the officers and members of the National Fertilizer Association have been conducting a campaign to add 100 new members to the roll of the Association. During the closing week of the year, applications were received from 9 new active members and 1 associate, bringing the total for the campaign up to 105 new actives and 5 new associates. The services which the Association has been rendering to the entire industry during the war months has demonstrated to the fertilizer manufacturer the benefits to be obtained from membership in such an efficient and active organization.

Opinions on 1943 Tonnage and Fertilizer Distribution

At each of the ten regional meetings held at the request of WPB to discuss M-231 as amended, those present were asked to indicate their opinion as to the demand for fertilizer for the 1943 spring season. A few individuals believed it would be less than 90 per cent and a few that it would be more than 100 per cent, but nearly all expressed the opinion that the demand would fall between 95 and 100 per cent of the consumption in 1942.

State officials or industry representatives offered and adopted resolutions at each of the meetings to the effect that those present express their approval of the program of fertilizer distribution provided in M-231 and their disapproval of any plan which provided rationing to the individual farmer. Of the more than 1,000 attending the total of 10 meetings, only one individual voted in opposition to the M-231 plan and in favor of rationing.

Supplement to Vegetable Meal Ceiling

Ceiling prices for processors of soybean, cottonseed and peanut oil meals and oil cakes in carload lots are fixed at the same levels as those set under their contracts with the Commodity Credit Corporation, the Office of Price Administration announced on December 24th.

At the same time, some existing provisions of the General Maximum Price Regulation were simplified and restated to set differentials and profit margins for sales by processors of less than carload lots and for sales by jobbers, wholesalers and retailers.

The move—taken in amendment No. 81 to supplementary regulation No. 14, effective December 29, 1942—should further effectuate the $3 to $4 per ton reduction in costs of all oil meals and oil cakes to the individual farmer-feeders, which has been the purpose of OPA in designing this order.

Previously, amendment No. 61 to supplementary regulation No. 14 fixed maximum margins that may be charged by jobbers, wholesalers and retailers of oil meals and oil cakes over actual cost of these products. This amendment was issued as an emergency order to halt the practice of some persons purchasing oil meals and oil cakes at processor's prices as fixed by CCC contract and selling at previous OPA ceilings, which were $3 to $15 per ton higher than processor's prices.

The new amendment fixes margins that can be charged over the processor's ceiling prices as set by contract with CCC on cottonseed meal and cake, soybean oil meal and cake and peanut meal and cake. In other words, if a jobber bought below the processor's ceiling he now may add his fixed margin to the ceiling price rather than cost price. Other oil meals still are controlled by amendment No. 61, OPA officials indicated.

November Sulphate of Ammonia

The figures issued by the United States Bureau of Mines on the production of by-product sulphate of ammonia during November show that production is continuing at about 2,000 tons per day. November showed a decrease of 3.1 per cent from October, which is accounted for almost exactly by the shorter month. Sales increased during the month, with the result that stocks on hand at the end of the month had decreased about 5,000 tons. Figures for production, sales and stocks are as follows:

	Sulphate of Ammonia	Ammonia Liquor
Production	Tons	Tons NH_3
November, 1942	62,908	2,901
October, 1942	64,903	2,992
November, 1941	61,344	2,515
January–November, 1942	703,008	31,077
January–November, 1941	679,595	28,605
Sales		
November, 1942	68,284	3,017
October, 1942	63,802	3,035
November, 1941	62,684	2,724
Stocks on Hand		
November 30, 1942	49,924	1,034
October 31, 1942	55,447	1,016
November 30, 1941	32,601	707
October 31, 1941	35,252	691

Plant Scientists Develop New Plants for War Needs

New varieties of plants created to meet wartime specifications are among current research results cited by Robert M. Salter, Chief of the Bureau of Plant Industry, in his annual report to Secretary Wickard on work of the Bureau.

Meeting war needs required the time of specialists throughout the Bureau, one of seven research agencies in the Department of Agriculture consolidated during the year in the newly established Agricultural Research Administration.

War jobs in the last fiscal year included the determination of best areas and cultural methods for growing strategic crops for the production of rubber, drugs, oils, and fibers. Others were the development of cereal grains with waxy starch to replace imported root starches, improved methods for growing vegetable seeds, a new quick test for the effectiveness of preservative treatments used on sand bags, and the evaluation of new fungicides to replace scarce metallic compounds for controlling plant diseases.

"Never before have the farmers of this nation faced a challenge to produce food and fiber for such a large share of the world's population," says Mr. Salter. "With shortages of labor, equipment, and materials, they can meet this challenge only through more efficient production. Thus the results of plant and soil research that have made possible an increasingly efficient production are more in demand than ever before."

Soybeans, introduced by the Bureau of Plant Industry from the Orient many years ago, now play a major role in providing oil for food and industrial uses. In the last few years hundreds of new varieties of soybeans have been created by plant breeders to meet

(Continued on page 20)

Crop Production for 1942

The final checkup of acreages harvested and yields obtained has now confirmed earlier predictions of a 1942 harvest far above any in the past. Although estimates of a number of crops have been reduced by new information on acreages harvested and by allowances for losses from frost, storms and harvesting difficulties, the total volume of crops produced is expected to be 14 per cent larger than production last year and nearly 12 per cent larger than in 1937, the banner year of the past. The totals for the various groups of crops show a well-balanced harvest that includes record crops of food grains, feed grains, hay and forage, oil seeds, beans and peas, fruits and commercial vegetables. Sugar and sirup crops are only a little below the top record, and cotton, tobacco and potatoes show about average production. The list of individual crops showing definitely less than average production is significantly short, for it includes few except sweet potatoes, wild pecans, certain hay crop seeds, broomcorn, and melons. With some local exceptions, such shortages of important crops as may now exist are attributed more to the unprecedented wartime demand, or to interrupted transportation, than to light production.

Although the acreage in crops was increased about 2 per cent this year, the exceptionally high level of production comes primarily from increased crop yields per acre. These yields average 35 per cent higher than yields during the fairly typical "predrought" decade of 1923–32, and 14 and 12 per cent higher than the yield averages of 1940 and 1941, each of which topped previous peaks by about 1 per cent. The outstanding high yields of 1942 were made possible by a combination of unusually favorable weather, progressive improvement of plant materials

(Continued on page 20)

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FERTILIZER MATERIALS MARKET

NEW YORK

Permission for Increased Fertilizer Prices Expected Soon. Oil Meals Unobtainable. Nitrate of Soda Prices Unchanged. Supplies of Moroccan Phosphate Rock May Help Superphosphate Situation.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, December 29, 1942.

Recently there have been several meetings and it has been intimated that a general price increase will be allowed for mixed fertilizers but nothing definite has as yet been released. The fertilizer manufacturers expected to use considerable quantities of oil meals and higher prices for the mixed goods would be necessary if these meals were used but developments have now arisen and various meals are practically unobtainable.

Sulphate of Ammonia

While production is up to anticipation, nevertheless the allocation for fertilizer manufacturers is still far below anticipated needs, with practically no prospects of additional quantities being allocated for use as fertilizer.

Nitrate of Soda

Domestic manufacturers have issued their price for January, same being the same as for December and it is anticipated that the price for Chilean nitrate of soda will also remain the same. There is no change in this situation as far as the fertilizer manufacturer is concerned.

Potash

This material continues tight but as a whole fertilizer manufacturers are fairly well taken care of.

Dried Blood

There is no change in the situation.

Fish Meal

This material is unavailable.

Superphosphate

Production of ordinary superphosphate is large with expected ample supplies.

As mentioned about a month ago, it is now rather definitely established that Moroccan phosphate rock will move into England. The U. S. Board of Economic Warfare and the United Kingdom Ministry of Economic Warfare have arranged for allocations of the raw material found in French North Africa. They have decided that iron ore and pyrites, as well as phosphate rock and superphosphate, shall move from North Africa to England. The production of phosphate rock in French North Africa is second only to the large production in the United States and should help materially in furnishing phosphate needed by England. Actually, these movements will be dependent on the shipping situation but with cargoes moving from England into North Africa regularly, it is fair to assume that these steamers will be able to take rock on their return voyage. It is possible that this may release, to some extent, the triple superphosphate which has been moving from this country to England but it will be some time before it can actually be determined to just what extent this Moroccan rock will help the English situation.

BALTIMORE

Little Change in Situation. Animal Ammoniates Beyond Fertilizer Price Range. Additional Nitrate of Soda Allocated.

Exclusive Correspondence to "The American Fertilizer"

BALTIMORE, DECEMBER 29, 1942.

There have been no outstanding developments in the fertilizer industry during the past two weeks, as is usual at this time of the year.

Ammoniates.—There have been practically no offerings of blood or tankage on the market for fertilizer purposes, as offerings are usually taken up for feeding purposes at

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higher prevailing prices than fertilizer manufacturers can afford to pay.

Nitrogenous Material.—There is none offering at the present time.

Vegetable Meals.—These are in short supply although it is hoped there will be some tonnage available after January or February at prevailing ceiling prices for the different grades.

Sulphate of Ammonia.—Fertilizer manufacturers are still unable to secure allocations of this commodity in anything like normal quantities, as the major portion of the production is being used for National Defense purposes.

Nitrate of Soda.—There have been some additional allocations of this commodity issued recently, which manufacturers have been glad to accept to use in mixtures replacing sulphate of ammonia. The market remains unchanged at previous quotations.

Potash.—The demand is practically at a standstill, but most manufacturers have ample supplies on hand and to arrive under current contracts to cover current requirements.

Superphosphate.—There is no change in the situation and the market continues at ceiling price of $9.60 per ton of 2,000 pounds, basis 16 per cent for run-of-pile. No stocks are accumulating.

Bone Meal.—Both raw and steamed bone meal are practically unobtainable and such quantities as are being held are all out of proportion with other fertilizer ingredients.

Bags.—While it is reported that shipments of burlap from Calcutta are now increasing, up to the present time there have not been any changes in regulations regarding use of new burlap bags for Fertilizer. Second-hand bags, however, are still permissible.

ATLANTA

Prices on AAA Superphosphate About the Same as Previously. Disappointment Over Vegetable Meals for Fertilizer Use.

Exclusive Correspondence to "The American Fertilizer"

ATLANTA, December 28, 1942.

Some of the acidulators in the Southern territory were being notified of acceptance of bids on superphosphate by the U. S. D. A. It was understood that the prices ruled about the same as on the tonnage purchased by the Department of Agriculture for shipment over the last half of 1942.

Many of the fertilizer manufacturers are experiencing disappointment due to the difficulty in obtaining vegetable oil meals. Up until recently there was a feeling there would be an adequate supply of these meals for fertilizer purposes. It is reported that the oil mills have been requested to offer such soya bean meal as has been released to them by the Commodity Credit Corporation to the feed mills to take care of their critical situation at the moment.

Manufacturers were still awaiting over the holidays publishing of the order by the OPA relating to prices on mixed fertilizer for the coming season.

The supply of organic ammoniates continues very meager with a strong demand.

CHARLESTON

Offerings of Organics Very Meager as Feed Market Takes Most of Supply. Advance in Fertilizer Ceiling Awaited.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, December 29, 1942.

The manufacturers hope within the next two or three days to receive notice from the OPA giving them permission to raise their prices on mixed goods, but the general opinion now is that this advance will be less than they had hoped.

Manufacturers' Sales Agents for **DOMESTIC**

Sulphate of Ammonia

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Nitrogenous.—There are still no offerings of this material.

Castor Meal.—In spite of some recent arrivals of beans, no quotations on castor meal are available.

Blood.—What little blood is left after the quantity required by the packers for their own uses is being eagerly taken up by the feed manufacturers.

Cottonseed Meal.—Any figures quoted now are nominal as apparently there is no material to be obtained.

Soya Meal.—It does not look probable now that the fertilizer manufacturers will be able to obtain any of this material in time for the spring season.

CHICAGO

Holiday Dullness in Market. Bone Meals Out of Fertilizer Price Range. Feed Material Supply Limited.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, December 28, 1942.

The usual holiday dullness prevails in this market, though the dearth of offerings continues. The trade is in hopes the turn of the year will bring to light some nitrogen offerings but, judging from observation, there will be considerable disappointment. The total withdrawal of steamed and raw bone meals for fertilizer use is worthy of note. All this material is now going into feed at prices beyond the fertilizer ken.

Offerings of feed material are very scarce. the producers being generally well sold up.

No change in ceiling prices in the various zones: High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.98½ per unit N) and 10 cents; standard grades crushed feeding tankage; $5.53 per unit ammonia ($6.72 per unit N); blood, $5.38 ($6.54 per unit N); dry rendered tankage, $1.21 per unit of protein, Chicago basis.

TENNESSEE PHOSPHATE

End of Year Finds Phosphate Production and Shipments Still at High Levels. Record Year in All Departments.

Exclusive Correspondence to "The American Fertilizer"

COLUMBIA, TENN., December 29, 1942.

Reasonably good weather has been the rule for the past two weeks, with a very active phosphate industry. Farmers are active in all lines, especially with fine crops of tobacco bringing the usual top prices of the entire burley belt. Farm products all in good demand at good prices. It was no wonder that in spite of the terrible war that clouds all strata of society everywhere, in spite of gas and other rationing and the many apparently burdensome but really petty sacrifices all are called upon to make, this section experienced one of the quietest and happiest celebrations of the birth of the Prince of Peace that has been known in years.

The year 1942 is closing with the hitherto unprecedented record of having witnessed no recessions in shipments, and no real peak seasons, with valleys between, which have for forty-odd years caused the phosphate business to be either a feast of heavy shipping demand, or a famine of orders to take care of production, causing one element of great cost uncertainty. The curve of shipments, instead of having two enormous peaks centering in March and September, with valleys between that often go clear down to the bedrock of almost no shipments, stands this year as an almost level line, with the incline, such as there was, going steadily up, with only occasional dips caused by breakdowns or unavoidable interruptions of production, but never during the entire year for lack of orders.

As 1942 closes there is almost a complete lack of stocks on hand of any significant amount, either in mined material ready for processing or processed material awaiting shipment, which creates the healthiest possible condition of one hundred per cent em-

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NATURAL CHILEAN NITRATE

MENTION "THE AMERICAN FERTILIZER" WHEN WRITING TO ADVERTISERS.

ployment as compared with the considerable destitution among industrial workers not able to find employment ten years ago and for several years thereafter.

OPA ceilings have permitted all the large producers to increase their former contract prices, which were all still reflecting the depression levels of seven or eight years ago, with the prices of non-producers who buy and sell, frozen at the March, 1942, levels. This apparent hardship is made up by the greater volume of business being done by all these sellers, enabling them to operate with much lower margins than when they always had phosphate bought which they were unable to entirely dispose of.

Some large producers have materially curtailed the sales made by them to AAA, fertilizer manufacturers and other large wholesale buyers, thus leaving increased amounts available to direct channels, which are now taking practically the entire fine grinding capacity of the field. This channel has consumed during 1942 more than 120,000 tons from Tennessee and apparently a larger amount from Florida. This makes a significant contrast with 1921 to 1924 when the entire tonnage to this channel ranged from 1,900 to 9,000 tons with little or none from Florida. The time will come and should be here now, when the entire Tennessee production will go for direct use and electric furnaces, leaving superphosphate trade to Florida and the West.

Cottonseed Meal Production Increasing

During the first four months of the crop year, from August 1st to November 30th, production of cottonseed cake and meal totaled 913,129 tons compared with 778,187 tons during the same period of 1941. Supplies on hand at the end of the month were only 117,778 tons.

I. M. C. Magnesium Plant

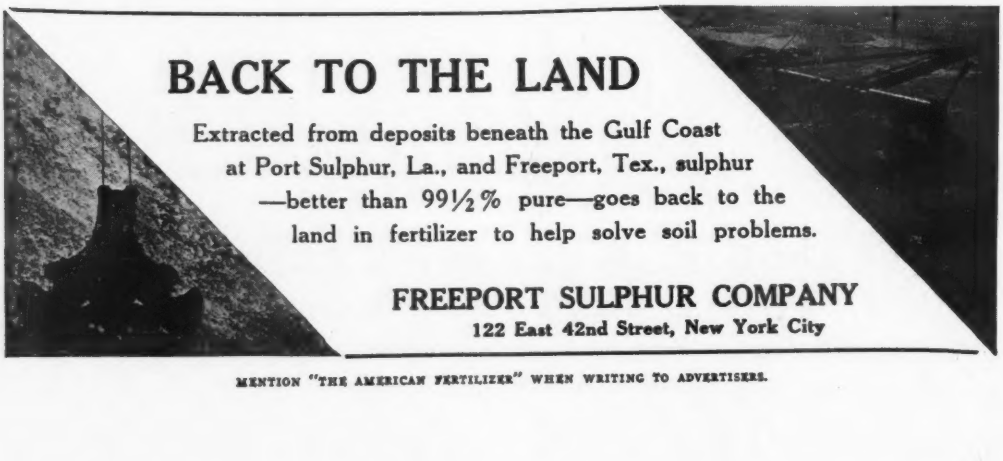
The new magnesium plant of International Minerals and Chemical Corporation in Texas is the third large magnesium plant designed and built by The Austin Company, engineers and builders, to enter production since Pearl Harbor. All three were built with funds provided by the Defense Plant Corporation and use the Dow process.

With magnesium output still being expanded to meet demands for this lightest of all structural metals used in aircraft, incendiary bombs and other ordnance material, the Austin organization still has several hundred engineers and over five thousand construction workers at work on design and erection of additional magnesium producing facilities.

Brand Attends South American Congress of Chemistry

Charles J. Brand, executive secretary and treasurer of the National Fertilizer Association, left from Miami on December 25th by Pan-American Airways to attend, upon invitation of the Ambassador of Chile, the Fourth South American Congress of Chemistry to be held at Santiago, January 5th to 12th. He goes via the east coast and returns via the west coast. He will study also, so far as his time permits, cotton and coffee production in the vicinity of Sao Paulo, Brazil; and livestock and alfalfa production and fertilization practices, including nitrogen conservation, in the vicinity of Buenos Aires; and will visit the ancient terrace farming operations near Lima, Peru.

The major part of his time will be devoted, of course, to the nitrate industry, which is of intense importance as a present and future problem. During World War I Mr. Brand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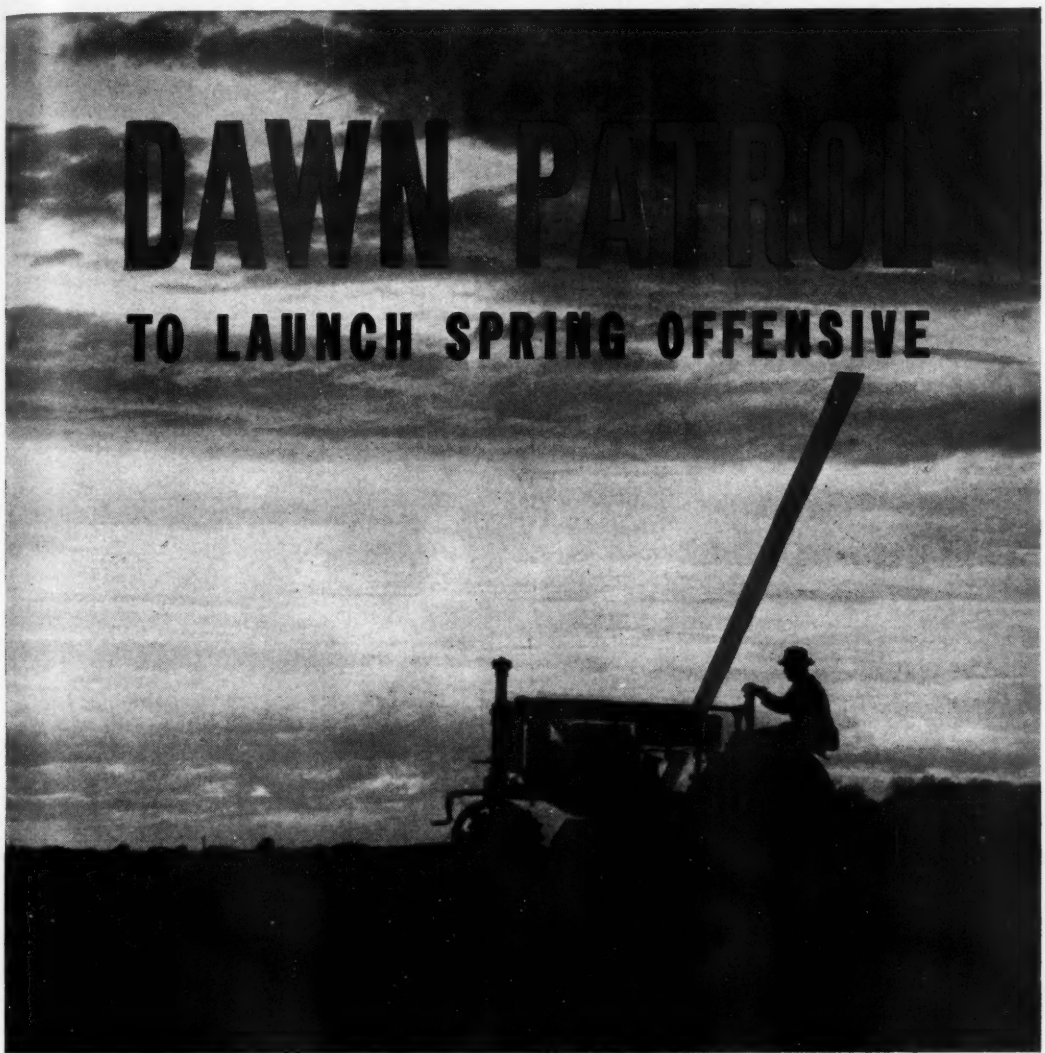

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was in charge of the Federal distribution of nitrate of soda to farmers, which was specifically directed by law. In 1923 he reported on the commerce in nitrate of soda on the Continent and in Great Britain, and in 1929 on the synthetic nitrogen industry of the Continent. A large part of the deliberations of the Congress of Chemistry is expected to be concerned with nitrogen. In addition, Mr. Brand will make a personal study of the nitrogen situation as it relates to war-time supplies and post-war problems, will visit the nitrate beds and officinas at Antofagasta, and will study at first hand the Chilean nitrate industry. He expects to be gone about three weeks.

PLANT SCIENTISTS DEVELOP NEW PLANTS FOR WAR NEEDS

(Continued from page 12)

specific needs in various localities. Much of the research has been aimed at developing varieties with higher oil content and others better suited to forage production—work that is now extremely important.

Lend-lease commitments to Great Britain and other allies last year called for a large increase in acreage of the four principal canning crops—tomatoes, peas, beans, and corn. In every instance, Mr. Salter pointed out, superior new varieties developed by the Bureau and cooperating state experiment stations are making it easier for farmers to meet production goals.

Notable progress also has been made in the improvement of forage crops to be used as livestock feed and for soil improvement. Two new varieties of red clover and several new sweetclovers have just been released to farmers, and a new wilt-resistant alfalfa will soon be ready for release.

Many new factories have been built to manufacture synthetic nitrogen compounds for use in the production of munitions. Anticipating that the output of many of these factories may be available for fertilizers at the end of the war, Salter reported that fertilizer chemists of the Bureau are now investigating methods of combining greater quantities of nitrogen with other fertilizer elements. Aside from the technical phases of the problem, there is the much larger question of how much of this cheaper nitrogen farmers can afford to use on various crops. Work now in progress is designed to help answer this question.

In the past year new research has also been undertaken in cooperation with the Forest Service to secure better utilization of lumber, plywood, and other tree products used in war construction. This work included the inspection of wood used in airplanes and boats and inspection of standing timber in Alaska to prevent waste from cutting trees infected by diseases that would make the lumber unsuited for military needs. Methods have been worked out for treating lumber to prevent decay and for protecting war housing from decay.

CROP PRODUCTION FOR 1942

(Continued from page 12)

and equipment and technique on the farms, and a war-time demand that called for maximum effort and insured a market for practically everything that farmers could produce. Furthermore the record production of feed and forage crops this season results, in part, from the demand created by the presence of record numbers of cattle, hogs, sheep and poultry on the farms, accumulated as a result of six favorable crop years in succession. The record production of feed and forage, in turn, gives assurance that the currently heavy production of livestock and livestock products will continue at close to record levels for some time, if weather conditions permit.

A review of statistics on the individual crops gives the impression that unusually favorable weather explains about half of the 36 per cent increase of crop yields over the pre-drought level. Reports on the "condition" of various crops at harvest time, which serve as a measure of weather influences and related factors such as insect pests and diseases, this year showed conditions averaging 19 per cent better than during the pre-drought period and nearly 10 per cent better than in 1941. Pastures, although heavily stocked, also responded to the well distributed rainfall and mild temperatures, and their condition

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Charleston, S. C.
Cincinnati, Ohio
Cleveland, Ohio
Detroit, Mich.
East St. Louis, Ill.
Greensboro, N. C.
Havana, Cuba
Henderson, N. C.
Montgomery, Ala.
Norfolk, Va.
No. Weymouth, Mass.
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Pierce, Fla.
Port Hope, Ont., Can.
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during the season from May 1st to October 1st averaged 14 per cent better than in the pre-drought period and better than in any season since 1919. Growing conditions were above average in nearly all States, but were especially good in the Great Plains area. In this area, crops and ranges were benefited by the subsoil moisture remaining from the exceptionally heavy rainfall of 1941 and were helped along by the above-normal rainfall of 1942. The heavier-than-average rainfall of this year also should assure a good start for grass and grain in 1943. Although conditions in 1942 were favorable for nearly all crops and in nearly all States, the factors affecting individual crops carry varying implications regarding future production.

CROP	Total Production (in thousands) Average 1930–39	*Indicated* 1941	1942
Corn, all, bu	2,307,452	2,677,517	3,175,154
Wheat, all, bu	745,575	943,127	981,327
Winter, bu	570,001	670,709	703,253
All spring, bu	175,574	272,418	278,074
Durum, bu	27,297	41,653	44,660
Other spring, bu	148,277	230,765	233,414
Oats, bu	1,016,061	1,180,663	1,358,730
Barley, bu	226,460	362,082	426,150
Rye, bu	37,870	45,364	57,341
Buckwheat, bu	7,365	6,038	6,687
Flaxseed, bu	11,252	32,285	40,660
Rice, bu	45,712	51,323	66,363
Popcorn, lb	[1]86,853	121,823	153,275
All sorghums for grain, bu	52,747	111,784	107,245
All sorghums for forage, tons[2]	8,803	16,572	13,603
All sorghums for silage, tons[3]	2,459	8,774	6,881
Cotton, lint, bales	13,246	10,744	12,982
Cottonseed, tons	5,890	4,788	5,790
Hay, all, tons	78,733	94,238	105,328
Hay, all tame, tons	69,650	82,736	92,245
Hay, wild, tons	9,083	11,502	13,083
Alfalfa seed, bu	1,101	1,049	974
Red clover seed, bu	1,057	1,469	1,082
Alsike clover seed, bu	314	313	256
Sweet clover seed, bu	887	787	725
Lespedeza seed, lb	65,786	178,700	179,700
Timothy seed, bu	1,755	1,274	1,624
Beans, dry edible, bags[4]	13,510	18,503	19,608
Peas, dry field, bags	2,471	3,700	7,160
Soybeans for beans, bu	36,385	105,587	209,559
Cowpeas for peas, bu	6,411	8,063	7,067
Peanuts picked and threshed, lb	1,067,438	1,476,845	2,504,440
Velvet beans,[5] tons	771	929	750
Potatoes, bu	370,045	355,602	371,150
Sweet potatoes, bu	73,208	62,144	65,380
Tobacco, lb	1,398,796	1,262,885	1,417,188
Sorgo sirup, gal	15,397	10,568	13,674
Sugarcane for sugar and seed, tons	7,428	5,471	6,487
Sugarcane sirup, gal	20,774	18,764	18,610
Sugar beets, tons	9,284	10,311	11,927
Maple sugar, lb	1,066	387	654
Maple sirup, gal	2,671	1,997	2,905
Broomcorn, tons	41	46	35
Hops, lb	[6]34,655	40,380	34,896
Apples, commercial crop bu	[6]123,832	[6]122,256	[6]127,655
Peaches, total, bu	[6]54,706	[6]74,364	[6]65,345
Pears, total, bu	[6]27,253	[6]29,530	[6]31,212
Grapes, total,[7] tons	[6]2,246	2,728	2,532
Cherries (12 States), tons	[6]141	[6]161	[6]200
Plums (2 States), tons	[6]70	[6]78	[6]77
Prunes, used fresh (3 States) tons	47	45	51
Prunes, canned (2 States) tons	21	39	30
Prunes, dried (3 States), tons	232	185	181
Oranges (5 States) boxes	60,179	84,534	84,144
Grapefruit (4 States), boxes	24,383	40,294	45,533
Lemons (Calif.) boxes	8,815	11,753	13,650
Cranberries (5 States), barrels	604	725	787
Pecans (12 States) lbs	81,166	121,488	78,100

[1] Short-time average.
[2] Dry weight.
[3] Green weight.
[4] Bags of 100 pounds (uncleaned).
[5] All purposes.
[6] Includes some quantities not harvested.
[7] Production includes all grapes for fresh fruit, juice, wine, and raisins.

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Agricultural authorities have shown that a lack of Boron in the soil can result in deficiency diseases which seriously impair the yield and quality of crops.

When Boron deficiencies are found, follow the recommendations of local County Agents or State Experiment Stations.

Information and references available on request.

AMERICAN POTASH & CHEMICAL CORPORATION
70 PINE STREET, NEW YORK CITY
Pioneer Producers of Muriate of Potash in America
See Page 4

BORON IN AGRICULTURE

(Continued from page 6)

Soil Types and Methods of Application

Soil types do not determine the occurrence of alfalfa yellows or response of alfalfa to borax applications. In general, the lighter soil types give a more consistent response to borax applications. However, the author saw yellows on alfalfa growing on delta soil in Tennessee and saw one of the worst cases of yellows on a Hachi River bottom soil. The Hachi soil responded very well to 20 pounds of borax per acre and yellows were eliminated.

The effect of borax applications on the seed set of alfalfa has been noted in New York, Vermont, Virginia, North Carolina, Tennessee, Alabama, and Canada. In 1940 Midgley and Dunklee (*7*) found that the borate-fertilized second crop of alfalfa, which had been allowed to go to seed, produced more than 35 times as much seed as the unborated check plot. Piland and Ireland (*3*) found where they had omitted the usual first cutting, blossoming occurred with little or no difference in the growth between the borax-treated and non-treated plot, except for yellows on the no-borax area. Later, it was observed that a good seed set was being obtained where the borax had been applied. A sample of seed from the borax treatment gave a germination count of 76 per cent; hard seed, 24 per cent.

Grizzard and Matthews (*5*) observed that the borax-treated areas at Williamsburg, Va., blossomed very profusely while the no-borax plots blossomed very sparingly. They believed this might have a bearing on the seed set of the crop and began work on it. They left strips across borax-treated and non-treated plots which were not cut at time of second cutting. During the blossoming period, 31 days, they had 7.14 inches of rain with an average daily temperature of 87 degrees F. The no-borax plots did not yield any seed whatever while the 15 pounds of borax per acre plots gave from 109.7 to 132.2 pounds of seed per acre. Germination counts ranged from 71 per cent to 75 per cent; hard seed from 24 per cent to 28 per cent. The findings on seed set are of importance because it may now be possible to breed adapted strains for the various states with varied conditions. It may also be possible to obtain two cuttings of hay and one crop of seed each year. Further work is being done along these lines.

Methods of application for the small amounts of borax used are varied. Many farmers use the common cyclone hand seeder which may be set to deliver 20 pounds of borax per acre. Others mix the borax with 50 or 100 pounds of sand and broadcast it. Some fertilizer companies are putting out a special alfalfa mix that contains from 60 to 200 pounds of borax per ton. The mix is then used at time of seeding or as a topdresser. The bags are usually tagged so the farmer will not use the fertilizer on other crops that might be sensitive to borax.

Borax may be applied at almost any time of the year. Application at time of seeding is usually recommended by authorities. With an established stand an early spring application will generally give good results. Many farmers apply borax after the first cutting and, if rainfall is optimum, get good response even on the second cutting.

The work on red clover, crimson clover, ladino, and lespedeza has not progressed to the point that alfalfa tests have, but it is thought that likely some published information will be available on some of those crops by the fall of 1943.

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L. W. HUBER COMPANY
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110 WILLIAM STREET, NEW YORK • NICHOLS, FLORIDA

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EFFECT OF FERTILIZER ON POTATO YIELDS

(Continued from page 7)

tilizer. If yields are weighted according to the number of tests run, the average increase due to the use of fertilizer would be 91.5 bushels for the 171 tests thus involved. In general, the experimental work was conducted on farms possessing a high soil-fertility level which helps to explain the comparatively high yields without fertilizer. In passing, it may be noted that, as a rule, better tuber shape and size and a lower percentage of culls and seconds were associated with the fertilizer treatments.

Summary

Potato yields obtained with and without fertilizer additions in potato fertilizer experiments in Maine, Michigan, New Jersey, New York, Ohio, Pennsylvania, and Virginia, totalling 171 field experiments, are presented. In some cases the comparisons ran for long periods—as long as 22 years in Aroostook County, Maine, on Caribou loam, the Irish Cobbler variety being grown throughout the entire period. The average difference in yield for fertilizer over no fertilizer obtained in this long-time Maine series, amounted to 140 bushels per acre annually, an increase of about 72 per cent. When the results for all areas are taken into consideration, the overall average increase due to fertilizer amounted to 73 bushels per acre, an average increase in yield of 42 per cent from use of fertilizer. If the results are weighted according to the number of tests in each area, the average increase would be 91.5 bushels, or 52 per cent.

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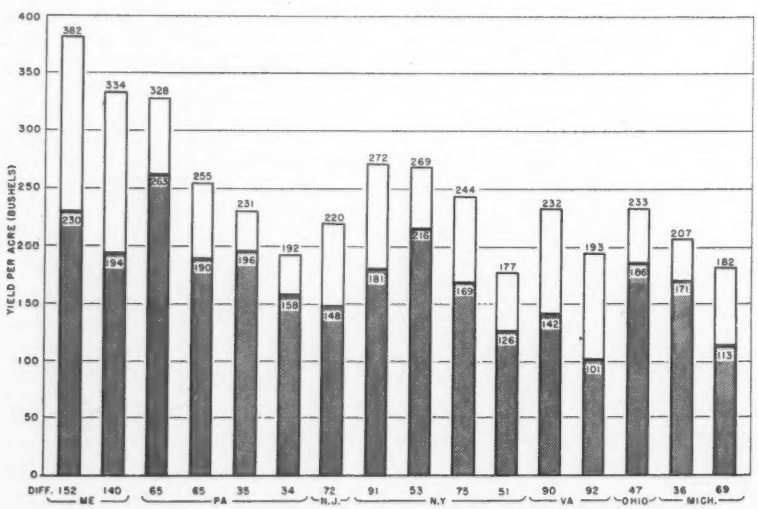

FIG. 2. Potato yields are greatly influenced by fertilizer treatment. Yields with fertilizer indicated at top of white bars; without fertilizer in the white spots at top of black sections. Yield increases due to fertilizer treatment are shown at bottom of black sections.

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ACID EGGS
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Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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MACHINERY—Tankage and Fish Scrap
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Sackett & Sons Co., The A. J., Baltimore, Md.
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MAGNETS
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corporation, Atlanta, Ga.

MIXERS
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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

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Chemical Construction Corp., New York City.

PHOSPHATE ROCK
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American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
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International Minerals & Chemical Corporation, Chicago, Ill.
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McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
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Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Virginia-Carolina Chemical Corp. (Mining Dept.), Richmond, Va.
Wellmann, William E., Baltimore, Md.

PIPE—Acid Resisting
Duriron Co., Inc., The, Dayton, Ohio.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
International Minerals & Chemical Corp., Chicago, Ill.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

ROUGH AMMONIATES
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McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
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SEPARATORS—Air
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Sackett & Sons Co., The A. J., Baltimore, Md.

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SHOVELS—Power
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corporation, Chicago, Ill., and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
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Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M. Charleston, S. C.

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Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
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Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
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Jett, Joseph C., Norfolk, Va.
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Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland, Norfolk, Va.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Sackett & Sons, Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
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Fairlie, Andrew M., Atlanta, Ga.

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UREA-AMMONIA LIQUOR
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VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
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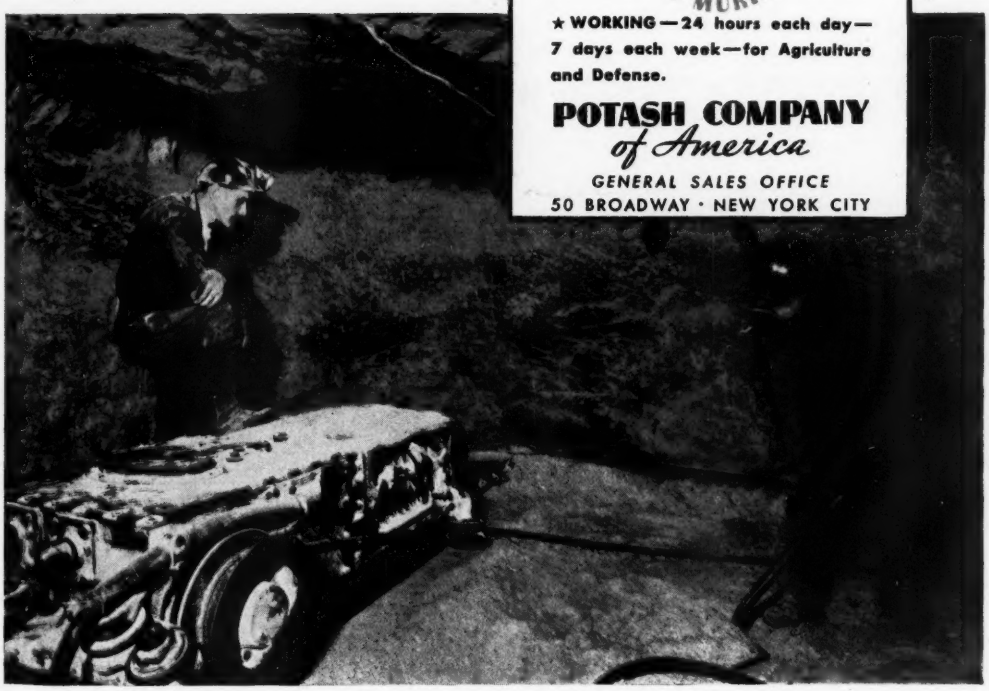

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